SCIENTIFIC AMERICAN.COM

March 20, 2003

A Gamma-Ray Burst, in Detail

Just like ET before it, NASA's High Energy Transient Explorer (HETE) satellite phoned home. As a result, astronomers were able to get the most detailed pictures yet of a gamma-ray burst and the evolution of its afterglow. In a report published today in the journal *Nature,* researchers describe a gamma-ray burst known as GRB021004 and note that it was 10 to 100 times more powerful than they expected.

Gamma-ray bursts typically last less than a hundred seconds, and much of the information gathered about them so far has relied on data from afterglows, which are lower-energy forms of light that can linger for days or weeks following the events. But after HETE relayed news of GRB021004, a telescope in Japan was collecting information from it in less than four minutes. Over the next few days, scientists focused more than 50 telescopes around the world on GRB021004. "If a gamma ray burst is the birth cry of a black hole, then the HETE satellite has just allowed us into the delivery room," says Derek Fox of the California Institute of Technology in Pasadena, Calif., and the lead author of the report.

The quick response allowed the astronomers to witness both the demise of the gamma-ray signal and the start of the afterglow signal. Surprisingly, they found that in the first half hour of its existence, the afterglow actually gained energy. "Gamma-ray bursts must be many times more powerful than we previously thought," notes George Ricker of the Massachusetts Institute of Technology. The authors say their findings support the so-called collapsar model for gamma-ray bursts, which posits that the explosions result from stars that are collapsing to form black holes. In this scenario, the star that led to GRB021004 would have been 15 times as massive as our sun. Comments Anne Kinney of NASA, "This stunning observation places us in the fiery throes of a star explosion, peering through the debris at a newly formed black hole within." --*Sarah Graham*